What is claimed is:

1. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are set by performing a weighted approximation to the desired characteristics in relation to the frequency response of the pre-filter.

2. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time

length, the impulse response being equivalent to the filter coefficients of the FIR filter, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and a transfer function K (z) of an equalizer,

wherein the filter coefficients are set on the basis of an amplitude characteristic of the equalizer which is obtained by performing a weighted approximation to the desired characteristics in relation to the frequency response of the pre-filter.

3. A setting method of filter coefficients of an FIR filter comprising <u>n-1</u> series-connected unit time delay elements, <u>n</u> multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the <u>n</u> multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are calculated by performing a weighted approximation to the desired

characteristics in relation to the frequency response of the pre-filter.

4. A setting method of filter coefficients of an FIR filter according to claim 3, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account a frequency response of the pre-filter.

5. A setting method of filter coefficients of an FIR filter comprising <u>n-1</u> series-connected unit time delay elements, <u>n</u> multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the <u>n</u> multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and a transfer function K (z) of an equalizer,

wherein the filter coefficients are calculated depending on an amplitude characteristic of the equalizer, which is obtained by performing a weighted

approximation to the desired characteristics in relation to the frequency response of the pre-filter.

6. A setting method of filter coefficients of an FIR filter according to claim 5, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of a pre-filter.

7. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response being expressed by a finite time length, and the impulse response is equivalent to the filter coefficients, comprising:

a first step for generating an interpolation polynomial equation for interpolating an amplitude characteristic from the extreme value point of the amplitude characteristic of the frequency;

a second step for determining a new extreme value point from the amplitude characteristic obtained from the

interpolation polynomial equation that is generated in the first step;

a third step for judging whether or not a position of the extreme value is approximated within the required range by repeating the operations of the first step and the second step; and

a fourth step for finding the filter coefficients from the approximated amplitude characteristic obtained in the third step.

8. A setting method of filter coefficients of an FIR filter according to claim 7, further comprising an initial setting step for carrying out, at least, setting of the FIR filter, setting of the bandwidth, setting of coefficients of a pre-filter, and setting of an initial extreme value point, before executing the operation in the first step.

9. A setting method of filter coefficients of an FIR filter according to claim 7, wherein in the second step and the third step, the extreme-value of weighted approximation error calculated from the extreme-value point used for the interpolation is searched to the entire approximation, obtained extreme-value is defined as a new extreme-value point, and it is judged that the optimum approximation is obtained when the position of the extreme-value is not changed.

10. A setting method of filter coefficients of an FIR filter according to claim 7, wherein in the fourth step, the filter coefficients are calculated by performing a weighted approximation to the desired characteristics in relation to frequency response of the pre-filter.

11. A setting method of filter coefficients of an FIR filter according to claim 7, wherein in the fourth step, the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing the weighted approximation to the desired characteristics in relation to frequency response of the pre-filter.

12. A setting method of filter coefficients of an FIR filter according to claim 10, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

13. A setting method of filter coefficients of an FIR filter according to claim 11, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

14. An FIR filter comprising <u>n-1</u> series-connected unit time delay elements, <u>n</u> multipliers having filter

coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are set by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is variable and the bandwidth is fixed.

15. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose

impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and transfer function K (z) of an equalizer,

wherein the filter coefficients are set on the basis of an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is variable and the bandwidth is fixed.

16. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter

having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are calculated by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to the frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is variable and the bandwidth is fixed.

17. A setting method of filter coefficients of an FIR filter according to claim 16, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

18. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response being expressed by using a finite time length, the impulse response is equivalent to the filter

coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and a transfer function K (z) of an equalizer,

wherein the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to the frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is variable and the bandwidth is fixed.

19. A setting method of filter coefficients of an FIR filter according to claim 18, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

20. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose

impulse response is expressed by a finite time length, and the impulse response being equivalent to the filter coefficients, and whose number of tap is variable, and whose band is fixed, comprising:

a first step for generating an interpolation polynomial equation for interpolating an amplitude characteristic from an extreme value point of the amplitude characteristic of the frequency;

a second step for determining a new extreme value point from the amplitude characteristic obtained from the interpolation polynomial equation that is generated in the first step;

a third step for judging whether or not a position of the extreme value is approximated within required range by repeating the operations of the first step and the second step;

a fourth step for examining an attenuation quantity of a stop band from the approximated amplitude characteristic obtained in the third step;

a fifth step for comparing the examined attenuation quantity with the attenuation quantity of the designated stop band to judge whether or not the result of the comparison satisfies a predetermined condition;

a sixth step for changing the number of taps when the result of the comparison of the fifth step does not satisfy the predetermined condition; and

a seventh step for finding the filter coefficients from the amplitude characteristic approximated in the third step which satisfies the predetermined condition in the fifth step.

21. A setting method of filter coefficients of an FIR filter according to claim 20, further comprising an initial setting step for carrying out, at least, setting of the FIR filter, setting of the band, setting of coefficients of the pre-filter, and setting of initial extreme value point, before executing the operation of the first step.

22. A setting method of filter coefficients of an FIR filter according to claim 20, wherein in the fourth step, the minimum attenuation quantity in the stop band is examined, and in the sixth step, the number of the taps is increased.

23. A setting method of filter coefficients of an FIR filter according to claim 20, wherein in the seventh step, the filter coefficients and calculated by performing a weighted approximation with reference to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency

response of the pre-filter that satisfies the attenuation quantity of the stop band when the number of taps is variable and the bandwidth is fixed.

24. A setting method of filter coefficients of an FIR filter according to claim 20, wherein in the seventh step, the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing the weighted approximation with reference to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the attenuation quantity of the stop band when the number of taps is variable and the bandwidth is fixed.

25. A setting method of filter coefficients of an FIR filter according to claim 23, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

26. A setting method of filter coefficients of an FIR filter according to claim 24, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

27. An FIR filter comprising <u>n-1</u> series-connected unit time delay elements, <u>n</u> multipliers having filter

coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H(z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are set by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is fixed and the bandwidth is changeable.

28. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose

impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and transfer function K (z) of an equalizer,

wherein the filter coefficients are set on the basis of an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is fixed and the bandwidth is changeable.

29. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter

having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are calculated by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is fixed and the bandwidth is changeable.

30. A setting method of filter coefficients of an FIR filter according to claim 29, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

31. A setting method of filter coefficients of an FIR filter comprising <u>n-1</u> series-connected unit time delay elements, <u>n</u> multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the <u>n</u> multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the

filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and a transfer function K (z) of an equalizer,

wherein the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is fixed and the bandwidth is changeable.

32. A setting method of filter coefficients of an FIR filter according to claim 31, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

33. A setting method of filter coefficients of an FIR filter comprising <u>n-1</u> series-connected unit time delay elements, <u>n</u> multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder

connected to output terminals of the n multipliers, whose impulse response is expressed by finite time length, and the impulse response being equivalent to the filter coefficients, and whose number of tap is fixed, and whose band setting is changeable, comprising:

a first step for generating an interpolation polynomial equation for interpolating an amplitude characteristic from an extreme value point of the amplitude characteristic of the frequency;

a second step for determining a new extreme value point from the amplitude characteristic obtained from the interpolation polynomial equation that is generated in the first step;

a third step for judging whether or not a position of the extreme value is approximated within required range by repeating the operations of the first step and the second step;

a fourth step for examining an attenuation quantity of a stop band from the approximated amplitude characteristic obtained in the third step;

a fifth step for comparing the examined attenuation quantity with the attenuation quantity of the designated stop band to judge whether or not the result of the comparison satisfies predetermined condition;

a sixth step for changing the band setting when the result of the comparison of the fifth step does not satisfy a predetermined condition; and

a seventh step for finding the filter coefficient from the amplitude characteristic approximated in the third step which satisfies the predetermined condition in the fifth step.

34. A setting method of filter coefficients of an FIR filter according to claim 33, further comprising an initial setting step for carrying out, at least, setting of the FIR filter, setting of the band, setting of coefficient of a pre-filter, and setting of initial extreme value point, before executing the operation of the first step.

35. A setting method of filter coefficients of an FIR filter according to claim 33, wherein in the fourth step, the minimum attenuation quantity in the stop band is examined.

36. A setting method of filter coefficients of an FIR filter according to claim 33, wherein in the seventh step, the filter coefficients are calculated by performing the weighted approximation with reference to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the

attenuation quantity of the stop band when the number of taps is fixed and the bandwidth is changeable.

37. A setting method of filter coefficients of an FIR filter according to claim 33, wherein in the above described seventh step, the filter coefficients are calculated depending on the amplitude characteristic of the equalizer obtained by performing the weighted approximation with reference to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the attenuation quantity of the stop band when the number of taps is fixed and the band setting is changeable.

38. A setting method of filter coefficients of an FIR filter according to claim 36, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

39. A setting method of filter coefficients of an FIR filter according to claim 37, wherein the weighted approximation is performed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

40. An FIR filter comprising <u>n-1</u> series-connected unit time delay elements, <u>n</u> multipliers having filter

coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are set by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of a stop band, when the number of taps is variable and the bandwidth is changeable.

41. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose

impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and transfer function K (z) of an equalizer,

wherein the filter coefficients are set on the basis of an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is variable and band setting is changeable.

42. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter

having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are calculated by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is variable and band setting is changeable.

43. A setting method of filter coefficients of an FIR filter according to claim 42, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

44. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the

filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and a transfer function K (z) of an equalizer,

wherein the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter which satisfies the attenuation quantity of the stop band, when the number of taps is variable and band setting is changeable.

45. A setting method of filter coefficients of an FIR filter according to claim 44, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

46. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder

connected to output terminals of the n multipliers, whose impulse response is expressed by finite time length, and the impulse response being equivalent to the filter coefficients, and whose number of tap is variable, and whose band setting is changeable, comprising:

a first step for generating an interpolation polynomial equation for interpolating an amplitude characteristic from an extreme value point of the amplitude characteristic of the frequency;

a second step for determining a new extreme value point from the amplitude characteristic obtained from the interpolation polynomial equation that is generated in the first step;

a third step for judging whether or not position of the extreme value is approximated within required range by repeating the operations in the first step and the second step;

a fourth step for examining an attenuation quantity of a stop band from the approximated amplitude characteristic obtained in the third step;

a fifth step for comparing the examined attenuation quantity with the attenuation quantity of the designated stop band to judge whether or not the result of the comparison satisfies a predetermined condition;

a sixth step for changing the band setting when the result of the comparison of the fifth step does not satisfy the predetermined condition;

a seventh step for judging whether or not the current number of taps can satisfy the attenuation quantity of the stop band after changing the band in the sixth step;

an eighth step for changing the number of taps when judgement is performed that the current number of taps do not satisfy the attenuation quantity of the stop band in the seventh step; and

a ninth step for finding the filter coefficients from the amplitude characteristic approximated in the third step which satisfies the predetermined condition in the fifth step.

47. A setting method of filter coefficients of an FIR filter according to claim 46, further comprising an initial setting step for carrying out setting, at least, of the FIR filter, setting of the band, setting of coefficients of a pre-filter, and setting of initial extreme value point, before executing the operation of the first step.

48. A setting method of filter coefficients of an FIR filter according to claim 46, wherein in the fourth step, the minimum attenuation quantity in the stop band

is examined, and in the eighth step, the number of the tap is increased.

49. A setting method of filter coefficients of an FIR filter according to claim 46, wherein in the ninth step, the filter coefficients are calculated by performing the weighted approximation to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the attenuation quantity of the stop band when the number of taps is variable and band setting is changeable.

50. A setting method of filter coefficients of an FIR filter according to claim 46, wherein in the ninth step, the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing the weighted approximation with reference to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the attenuation quantity of the stop band when the number of taps is variable and the band setting is changeable.

51. A setting method of filter coefficients of an FIR filter according to claim 49, wherein the weighted approximation is executed to the desired characteristics

using Remez Exchange algorithms taking into account frequency response of the pre-filter.

52. A setting method of filter coefficients of an FIR filter according to claim 50, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

53. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are set by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter through which the attenuation quantity of the

designated frequency of a transition band is passed, and which satisfies the attenuation quantity of a stop band, when the number of taps is made to fix and band setting is changeable.

54. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and transfer function K (z) of an equalizer,

wherein the filter coefficients are set on the basis of an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of a pre-filter through which an attenuation quantity of a designated frequency of a transition band is passed, and which satisfies the attenuation quantity

of the stop band, when the number of taps is variable and the bandwidth is changeable.

55. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are calculated by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter through which the attenuation quantity of the designated frequency of the stop band is passed, and which satisfies the attenuation quantity of the stop band, when the number of taps is variable and the bandwidth is changeable.

56. A setting method of filter coefficients of an FIR filter according to claim 55, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

57. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and a transfer function K (z)′ of an equalizer,

wherein the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency

response of the pre-filter through which the attenuation quantity of the designated frequency of a stop band is passed, and which satisfies the attenuation quantity of the stop band, when the number of taps is variable and the bandwidth is changeable.

58. A setting method of filter coefficients of an FIR filter according to claim 57, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

59. A setting method of filter coefficients of an FIR filter, comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by a finite time length, and the impulse response being equivalent to the filter coefficients, and whose number of taps is fixed, and whose band setting is changeable, comprising:

a first step for generating an interpolation polynomial equation for interpolation an amplitude

characteristic from an extreme value point of the amplitude characteristic of a frequency;

a second step for determining a new extreme value point from the amplitude characteristic obtained from the interpolation polynomial equation that is generated in the first step;

a third step for judging whether or not a position of the extreme value is approximated within required range by repeating the operation in the first step and the second step;

a fourth step for examining an attenuation quantity of a stop band from the approximated amplitude characteristic obtained in the third step;

a fifth step for comparing the examined attenuation quantity in the fourth step with the attenuation quantity of the designated stop band to judge whether or not the result of the comparison satisfies a predetermined condition;

a sixth step for changing the band setting when the result of the comparison of the fifth step does not satisfy the predetermined condition;

a seventh step for examining the attenuation quantity of the designated frequency of a transition band which the attenuation quantity satisfies the predetermined condition in the fifth step;

an eighth step for comparing the attenuation quantity of the designated frequency of the transition band that is examined in the seventh step with the attenuation quantity of the designated transition band, and for judging whether or not the result of comparison satisfies the predetermined condition;

a ninth step for changing the setting of the band when the result of comparison of the seventh step does not satisfy the predetermined condition; and

a tenth step for finding the filter coefficients from the amplitude characteristic approximated in the seventh step which the amplitude characteristic satisfies the predetermined condition.

60. A setting method of filter coefficients of an FIR filter according to claim 59, further comprising an initial setting step for carrying out, at least, setting of the FIR filter, setting of the band, setting of coefficient of a pre-filter, and setting of initial extreme value point, before executing the operation of the first step.

61. A setting method of filter coefficients of an FIR filter according to claim 59, wherein in the fourth step, the minimum attenuation quantity in the stop band is examined.

62. A setting method of filter coefficients of an FIR filter according to claim 59, wherein in the tenth step, the filter coefficients are calculated by performing the weighted approximation to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the attenuation quantity of the stop band, and that causes the attenuation quantity of the designated frequency of the transition band to pass when the number of taps is fixed and band setting is changeable.

63. A setting method of filter coefficients of an FIR filter according to claim 59, wherein in the tenth step, the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing the weighted approximation to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the attenuation quantity of the stop band, and that causes the attenuation quantity of the designated frequency of the transition band to pass when the number of taps is fixed and the band setting is changeable.

64. A setting method of filter coefficients of an FIR filter according to claim 62, wherein the weighted

approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

65. A setting method of filter coefficients of an FIR filter according to claim 63, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

66. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are set by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the

pre-filter through which the attenuation quantity of the designated frequency of a transition band is passed, and which satisfies the attenuation quantity of a stop band, when the number of taps is variable and band setting is changeable.

67. An FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response being expressed by using a finite time length, the impulse response is equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and transfer function K (z) of an equalizer,

wherein the filter coefficients are set on the basis of an amplitude characteristic of an equalizer obtained by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter through which the attenuation quantity of the designated frequency of a transition band

is passed, and which satisfies the attenuation quantity of a stop band, when the number of taps is variable and band setting is changeable.

68. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of tap, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter,

wherein the filter coefficients are calculated by performing a weighted approximation to the desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter through which the attenuation quantity of the designated frequency of the stop band is passed, and which satisfies the attenuation quantity of the stop

band, when the number of taps variable and band setting is changeable.

69. A setting method of filter coefficients of an FIR filter according to claim 68, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

70. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by using a finite time length, the impulse response being equivalent to the filter coefficients of the FIR filter, the FIR filter having arbitrary number of taps, and whose transfer function H (z) is related to a transfer function Z (z) of a pre-filter and a transfer function K (z) of an equalizer,

wherein the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing a weighted approximation to the

desired characteristics so as to satisfy an attenuation quantity of a stop band in relation to a frequency response of the pre-filter through which the attenuation quantity of the designated frequency of the stop band is passed, and which satisfies the attenuation quantity of the stop band, when the number of taps is variable and band setting is changeable.

71. A setting method of filter coefficients of an FIR filter according to claim 70, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

72. A setting method of filter coefficients of an FIR filter comprising n-1 series-connected unit time delay elements, n multipliers having the filter coefficients, (n-1) multipliers being connected to input terminals of the corresponding unit time delay elements and n-th multiplier being connected to an output terminal of n-th time unit time delay element, and an adder connected to output terminals of the n multipliers, whose impulse response is expressed by a finite time length, and the impulse response being equivalent to the filter coefficients, and whose number of tap is variable, and whose band setting is changeable, comprising:

a first step for generating an interpolation polynomial equation for interpolating an amplitude characteristic from an extreme value point of the amplitude characteristic of a frequency;

a second step for determining a new extreme value point from the amplitude characteristic obtained from the interpolation polynomial equation that is generated in the first step;

a third step for judging whether or not a position of the extreme value is approximated within required range by repeating the operation in the first step and the second step;

a fourth step for examining attenuation quantity of a stop band from the approximated amplitude characteristic obtained in the third step;

a fifth step for comparing the examined attenuation quantity in the fourth step with the attenuation quantity of the designated stop band to judge whether or not the result of the comparison satisfies a predetermined condition;

a sixth step for changing the band setting when the result of the comparison of the fifth step does not satisfy the predetermined condition;

a seventh step for judging whether or not the current number of taps can satisfy the attenuation

quantity of the stop band after changing of the band in the sixth step;

an eighth step for changing the number of taps when judgement is performed that the current number of taps can not satisfy the attenuation quantity in the seventh step;

a ninth step for examining the attenuation quantity of the designated frequency of a transition band which the attenuation quantity satisfies a predetermined condition in the fifth step;

a tenth step for comparing the attenuation quantity of the designated frequency of the transition band that is examined in the ninth step with the attenuation quantity of the designated transition band, and for judging whether or not the result of comparison satisfies the predetermined condition;

an eleventh step for changing setting of the band when the result of comparison of the tenth step does not satisfy the predetermined condition;

a twelfth step for judging whether or not the current number of taps causes the signal to pass the designated frequency of the stop band after changing the band in the eleventh step;

a thirteenth step changing the number of taps when judgement is performed that the current number of

taps does not enable the designated frequency to be passed in the twelfth step; and

a fourteenth step for finding the filter coefficients from the amplitude characteristic approximated depending on the tenth step which amplitude characteristic satisfies the predetermined condition.

73. A setting method of filter coefficients of an FIR filter according to claim 72, further comprising an initial setting step for carrying out, at least, setting of the FIR filter, setting of the band, setting of coefficient of a pre-filter, and setting of the initial extreme value point, before executing the operation in the first step.

74. A setting method of filter coefficients of an FIR filter according to claim 72, wherein in the fourth step, the minimum attenuation quantity in the stop band is examined, and both in the eighth step and in the thirteenth step, the number of the taps is increased.

75. A setting method of filter coefficients of an FIR filter according to claim 72, wherein in the fourteenth step, the filter coefficients are calculated by performing the weighted approximation with reference to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the

attenuation quantity of the stop band, and that causes the attenuation quantity of the designated frequency of the transition band to pass when the number of taps is variable and band setting is changeable.

76. A setting method of filter coefficients of an FIR filter according to claim 72, wherein in the fourteenth step, the filter coefficients are calculated depending on an amplitude characteristic of the equalizer obtained by performing the weighted approximation to the desired characteristics so as to satisfy the attenuation quantity of the stop band in relation to the frequency response of the pre-filter that satisfies the attenuation quantity of the stop band, and that causes the attenuation quantity of the designated frequency of the transition band to pass when the number of taps is variable and the band setting is changeable.

77. A setting method of filter coefficients of an FIR filter according to claim 75, wherein the weighted approximation is executed to the desired characteristics using Remez Exchange algorithms taking into account frequency response of the pre-filter.

78. A setting method of filter coefficients of an FIR filter according to claim 76, wherein the weighted approximation is executed to the desired characteristics

using Remez Exchange algorithms taking into account frequency response of the pre-filter.